AOT1404L/AOB1404L

40V N-Channel Rugged Planar MOSFET

General Description

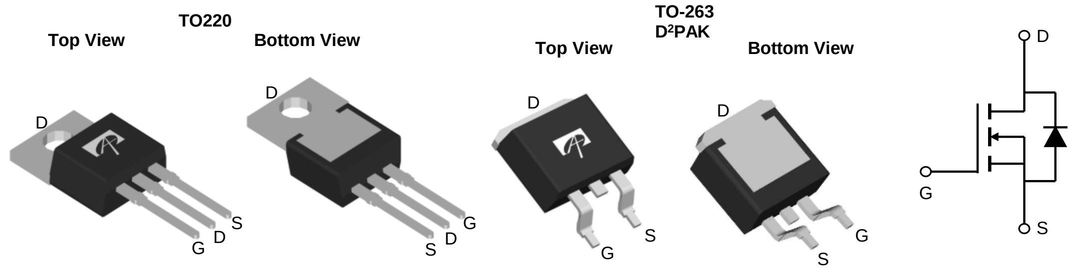
The AOT1404L/AOB1404L uses a robust technology that is designed to provide efficient and reliable power conversion even in the most demanding applications, including motor control. With low $R_{DS(ON)}$ and excellent thermal capability this device is appropriate for high current switching and can endure adverse operating conditions.

Product Summary

V_{DS}	40V
I_D (at V_{GS}=10V)	220A
$R_{DS(ON)}$ (at V_{GS}=10V)	< 4.2mΩ

100% UIS Tested
100% R_g Tested

RoHS Compliant



Absolute Maximum Ratings T_A=25°C unless otherwise noted				
Parameter		**Symbol**	**Maximum**	**Units**
Drain-Source Voltage		V_{DS}	40	V
Gate-Source Voltage		V_{GS}	±20	V
Continuous Drain Current [G]	T_C=25°C	I_D	220	A
	T_C=100°C		157	
Pulsed Drain Current [C]		I_{DM}	500	
Continuous Drain Current	T_A=25°C	I_{DSM}	15	A
	T_A=70°C		11	
Avalanche Current [C]		I_{AS}, I_{AR}	140	A
Avalanche energy L=0.1mH [C]		E_{AS}, E_{AR}	980	mJ
Power Dissipation [B]	T_C=25°C	P_D	417	W
	T_C=100°C		208	
Power Dissipation [A]	T_A=25°C	P_{DSM}	2.1	W
	T_A=70°C		1.3	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 175	°C

Thermal Characteristics					
Parameter		**Symbol**	**Typ**	**Max**	**Units**
Maximum Junction-to-Ambient [A]	t ≤ 10s	$R_{\theta JA}$	12	15	°C/W
Maximum Junction-to-Ambient [A D]	Steady-State		48	60	°C/W
Maximum Junction-to-Case	Steady-State	$R_{\theta JC}$	0.3	0.36	°C/W

Electrical Characteristics (T_J=25°C unless otherwise noted)

Symbol	Parameter	Conditions		Min	Typ	Max	Units
STATIC PARAMETERS							
BV_{DSS}	Drain-Source Breakdown Voltage	I_D=250µA, V_{GS}=0V		40			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=40V, V_{GS}=0V				1	µA
			T_J=55°C			5	
I_{GSS}	Gate-Body leakage current	V_{DS}=0V, V_{GS}= ±20V				100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS}, I_D=250µA		2.5	3.1	3.7	V
$I_{D(ON)}$	On state drain current	V_{GS}=10V, V_{DS}=5V		500			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=10V, I_D=20A TO220			3.6	4.2	mΩ
			T_J=125°C		6	7	
		V_{GS}=10V, I_D=20A TO263			3.3	3.9	mΩ
g_{FS}	Forward Transconductance	V_{DS}=5V, I_D=20A			55		S
V_{SD}	Diode Forward Voltage	I_S=1A,V_{GS}=0V			0.7	1	V
I_S	Maximum Body-Diode Continuous Current[G]					220	A
DYNAMIC PARAMETERS							
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=20V, f=1MHz		2840	3568	4300	pF
C_{oss}	Output Capacitance			960	1388	1810	pF
C_{rss}	Reverse Transfer Capacitance			85	151	215	pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz		1.5	3.1	4.7	Ω
SWITCHING PARAMETERS							
Q_g(10V)	Total Gate Charge	V_{GS}=10V, V_{DS}=20V, I_D=20A		55	71	86	nC
Q_{gs}	Gate Source Charge				15		nC
Q_{gd}	Gate Drain Charge				23		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=20V, R_L=1Ω, R_{GEN}=3Ω			16		ns
t_r	Turn-On Rise Time				30		ns
$t_{D(off)}$	Turn-Off DelayTime				54		ns
t_f	Turn-Off Fall Time				20		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=20A, dI/dt=500A/µs		35	45	55	ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=20A, dI/dt=500A/µs		225	287	350	nC

A. The value of $R_{\theta JA}$ is measured with the device mounted on 1in^2 FR-4 board with 2oz. Copper, in a still air environment with T_A =25° C. The Power dissipation P_{DSM} is based on R $_{\theta JA}$ and the maximum allowed junction temperature of 150° C. The value in any given application depends on the user's specific board design, and the maximum temperature of 175° C may be used if the PCB allows it.
B. The power dissipation P_D is based on $T_{J(MAX)}$=175° C, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.
C. Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)}$=175° C. Ratings are based on low frequency and duty cycles to keep initial T_J =25° C. Maximum UIS current limited by test equipment.
D. The $R_{\theta JA}$ is the sum of the thermal impedance from junction to case $R_{\theta JC}$ and case to ambient.
E. The static characteristics in Figures 1 to 6 are obtained using <300µs pulses, duty cycle 0.5% max.
F. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of $T_{J(MAX)}$=175° C. The SOA curve provides a single pulse rating.
G. The maximum current limited by package is 120A.
H. These tests are performed with the device mounted on 1 in^2 FR-4 board with 2oz. Copper, in a still air environment with T_A=25° C.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

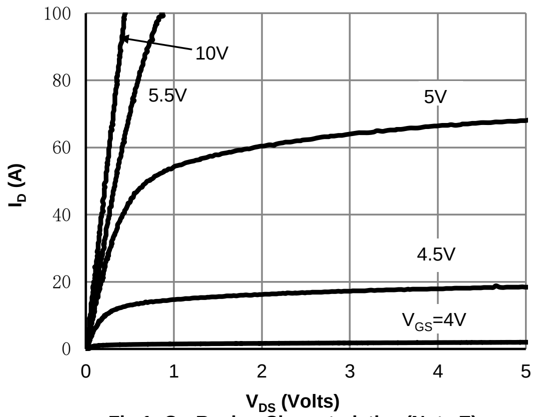


Fig 1: On-Region Characteristics (Note E)

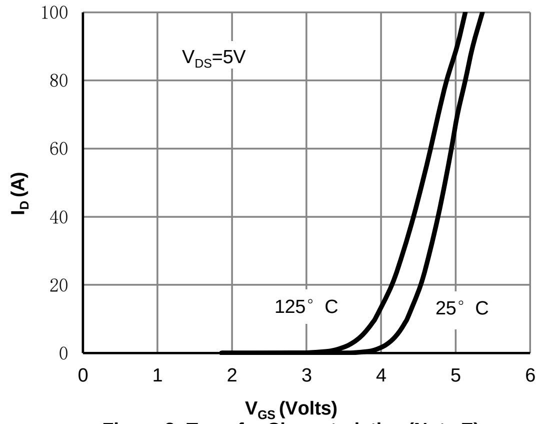


Figure 2: Transfer Characteristics (Note E)

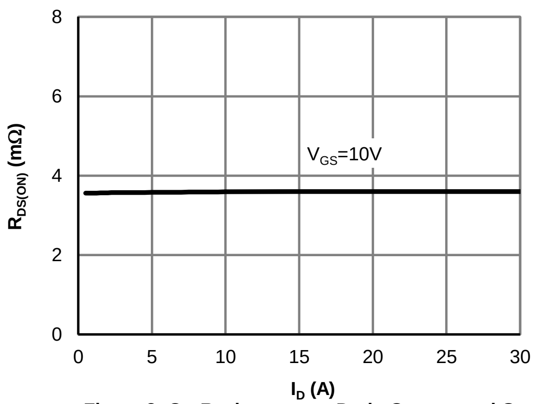


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

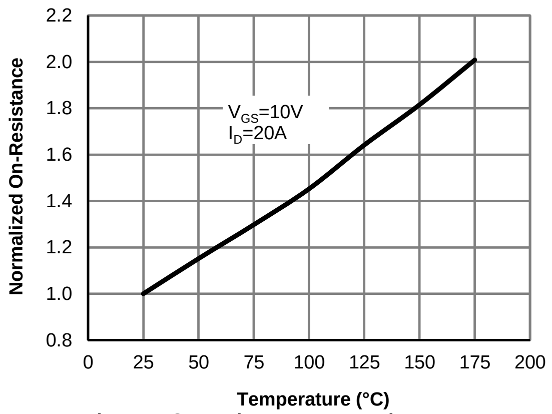


Figure 4: On-Resistance vs. Junction Temperature (Note E)

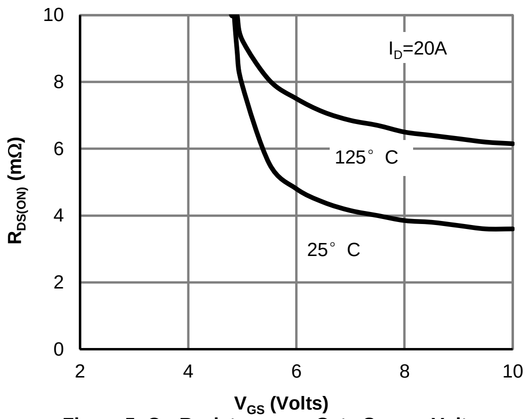


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

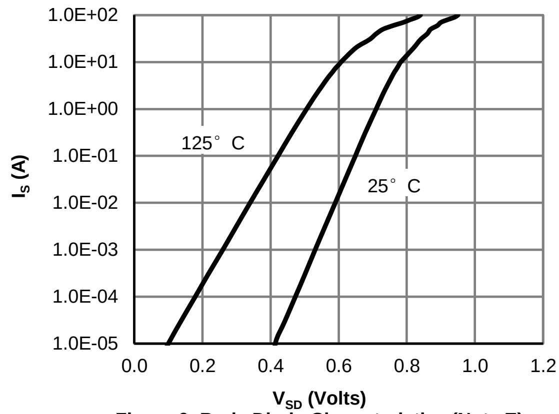


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

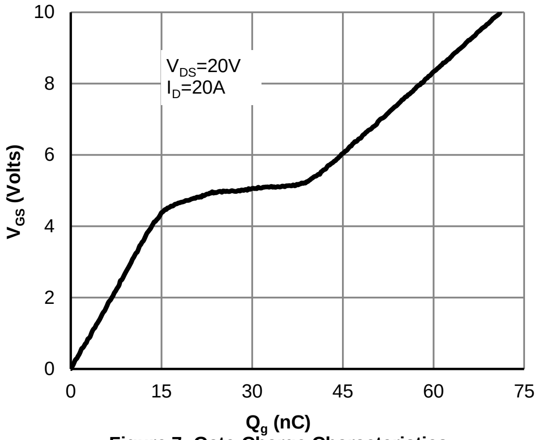


Figure 7: Gate-Charge Characteristics

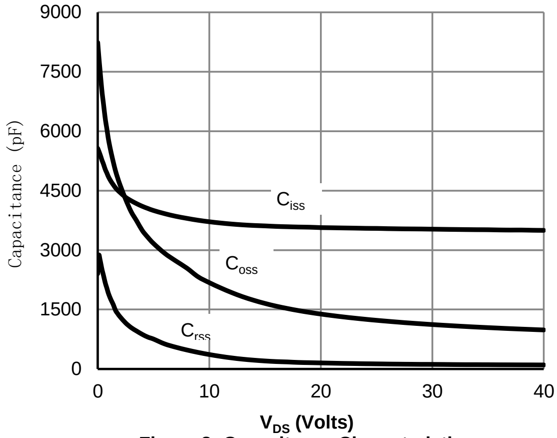


Figure 8: Capacitance Characteristics

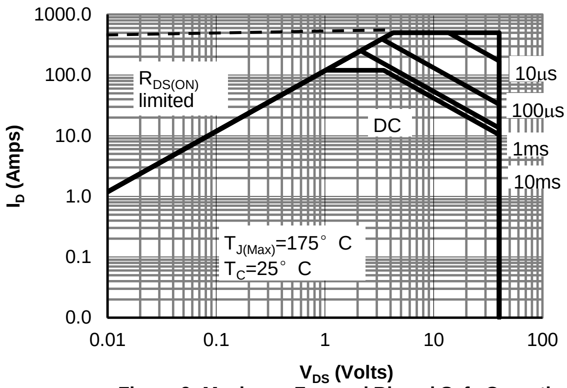


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

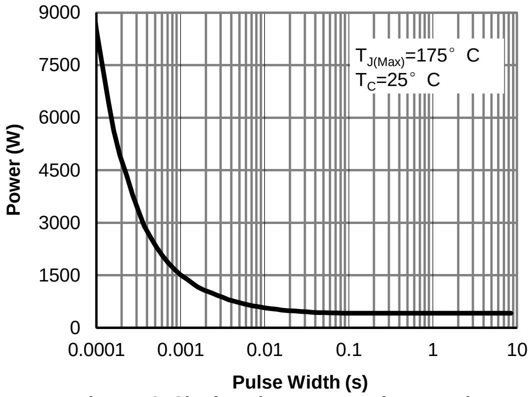


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

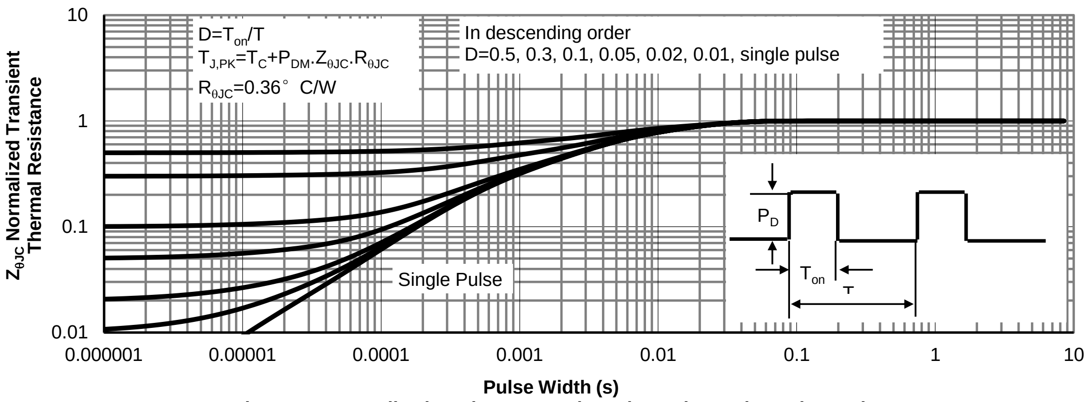


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

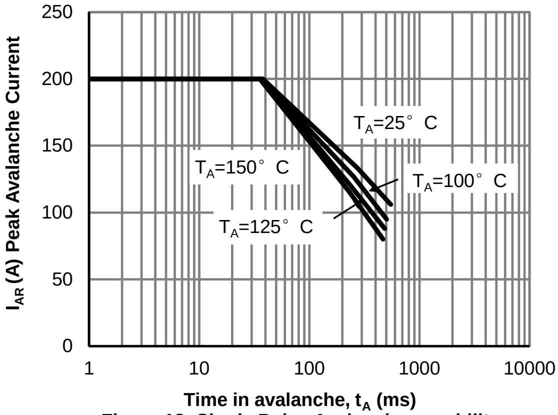


Figure 12: Single Pulse Avalanche capability (Note C)

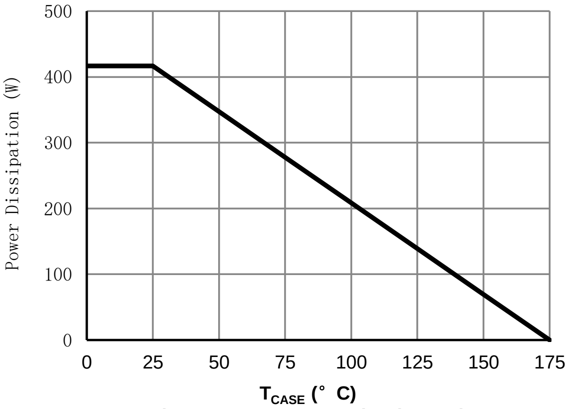


Figure 13: Power De-rating (Note F)

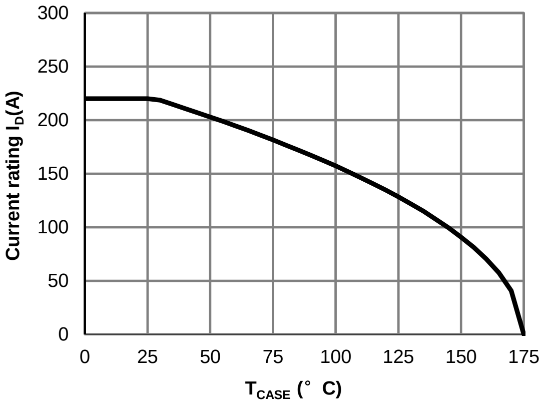


Figure 14: Current De-rating (Note F)

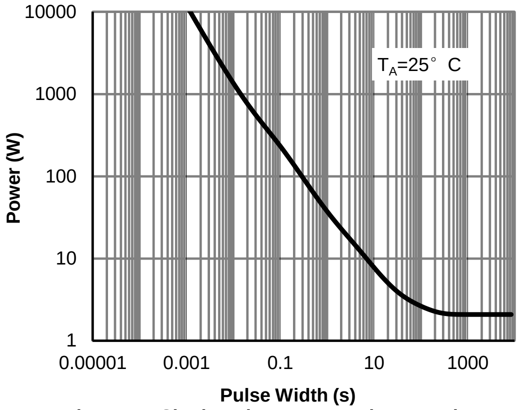


Figure 15: Single Pulse Power Rating Junction-to-Ambient (Note H)

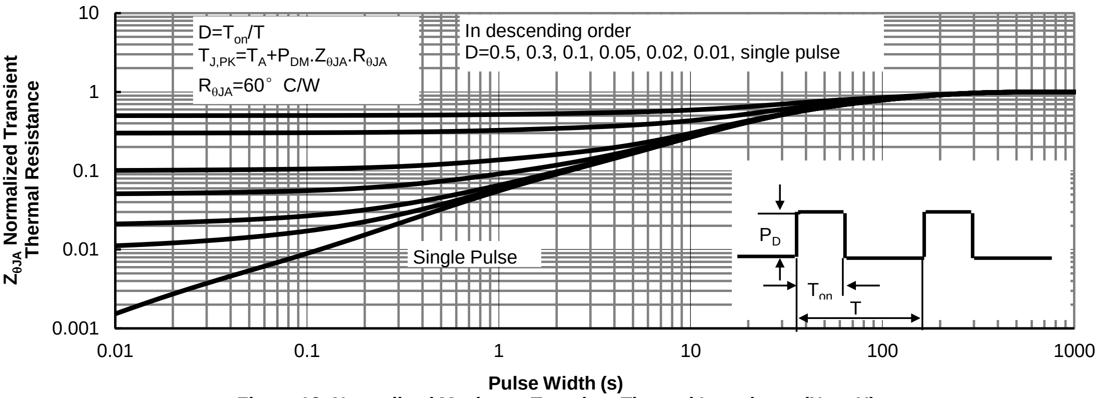
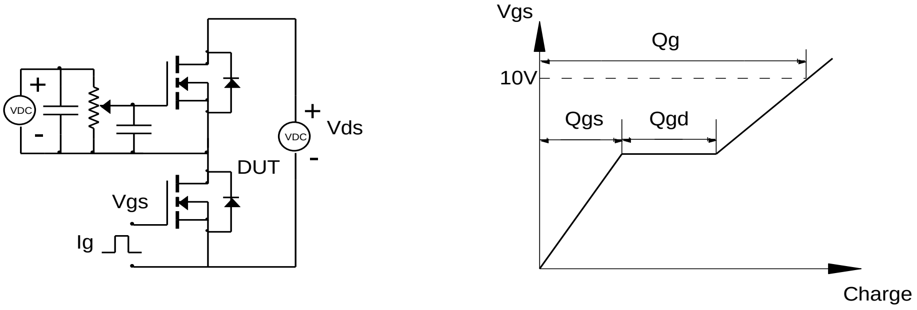
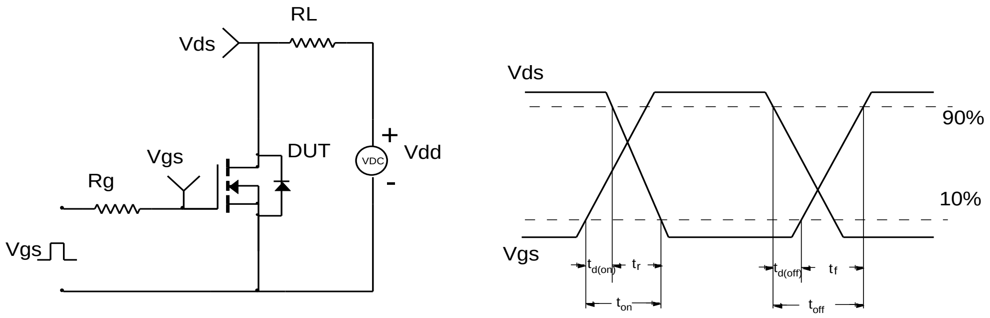


Figure 16: Normalized Maximum Transient Thermal Impedance (Note H)

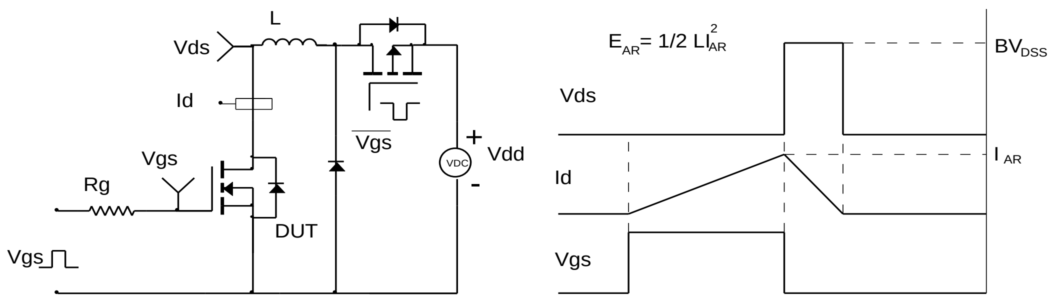
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms